

REMARKS

I. Status of the claims

Claims 1-12 are currently pending. Claims 3-10 and 12 have been withdrawn. Claim 1 has been amended to clarify that the amount of benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom is calculated based on the amount of the tert-alkylbenzene compound. Support for this amendment may be found, for example, on page 10, lines 12-22 of the specification.

No new matter has been introduced through this amendment.

II. Rejection under 35 U.S.C. § 103

The examiner has rejected claims 1-2 and 11 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2005/0053843 to Takahashi (“Takahashi”). The examiner states that Takahashi teaches a non-aqueous solvent electrolyte containing a cyclic acid anhydride and an aromatic compound having at least one electron donating group which comprises at least one member selected from tert-butylbenzene, sec-butylbenzene. According to the examiner, it would have been prima facie obvious to combine tert-butylbenzene and sec-butylbenzene to form a third composition to be used for the very same purpose; and although the amount of the compound is not specifically taught in Takahashi, it would have been obvious to one skilled in the art to discover the optimum ranges where general conditions of a claim disclosed in the prior art. Applicants respectfully traverse this rejection.

Amended independent claim 1 recites a non-aqueous electrolytic solution for a lithium secondary battery which comprises an electrolyte salt in a non-aqueous solvent, which contains a tert-alkylbenzene compound in an amount of 0.1 to 10 wt.% based on an amount of the solution and which further contains a benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom, in an amount of 0.5 wt.% or less and more than 0.001 wt.% based on the amount of the tert-alkylbenzene compound. Clearly, Applicants’ electrolytic solution contains both tert-alkylbenzene compound and benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom.

As noted above, claim 1 is amended to clarify that the amount of benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom is calculated based on the amount of the tert-alkylbenzene compound. Clearly, the amount of benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom is significantly smaller than the amount of tert-alkylbenzene compound in the electrolytic solution of the claimed invention.

Takahashi, however, does not teach or suggest the combination of tert-alkylbenzene and benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom. Nor does Takahashi teach or suggest that the amount of benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom is 0.5 wt.% or less and more than 0.001 wt.% based on the amount of the tert-alkylbenzene compound.

Takahashi teaches a non-aqueous solvent electrolyte containing a cyclic acid anhydride and an aromatic compound having at least one electron donating group, and the content of the aromatic compound containing the electron donating group ranges from 0.01-10 mass % based on the entire mass of the electrolyte. See Takahashi, claims 1 and 9, and paragraphs [0016] and [0030]. In Takahashi, sec-butylbenzene and tert-butylbenzene are merely listed as one of the choices of aromatic compound having at least one electron donating group that can be used with a cyclic acid anhydride as electrolyte. Hence sec-butylbenzene and tert-butylbenzene, as well as other aromatic compounds exemplified in Takahashi, are treated equally to be a candidate for aromatic compound having at least one electron donating group in Takahashi. Hence there would have been no reason or motivation for one skilled in the art a) to combine sec-butylbenzene and tert-butylbenzene; b) to further consider using a much smaller amount of sec-butylbenzene than the amount of tert-butylbenzene, and c) to particularly consider using such a specific amount of sec-butylbenzene with respect to the amount of tert-butylbenzene, such that the amount of sec-butylbenzene is 0.5 wt. % or less and more than 0.001 wt. % based on the amount of the tert-alkylbenzene compound.

In fact, the claimed non-aqueous electrolytic solution provides improved results unexpected from Takahashi. Applicants have discovered that benzene compound having a

benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom may be a by-product produced during the synthesis of tert-alkylbenzene compound and may degrade the cycle performance of the secondary lithium battery. See page 8, lines 27-35 of the specification.

By reducing the amount of the benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom (e.g., sec-butylbenzene) in an electrolytic solution to 0.5 wt. % or less and more than 0.001 wt. %, based on the amount of the tert-alkylbenzene compound, Applicants have shown that the cycle performance of a lithium secondary battery is improved. For example, Example Y-2 shows an electrolytic solution containing tert-butylbenzene, sec-butylbenzene (0.8 wt.% based on the amount of tert-butylbenzene) and isopropylbenzene (0.2 wt.% based on the amount of tert-butylbenzene). See Table 1 on page 26. A lithium secondary battery employing the electrolytic solution prepared from Example Y-2 presents 85.2 % of retention of discharging capacity after 100 cycles. See Example Z-3, Table 2 on page 27. Example B-2 shows an electrolytic solution containing tert-butylbenzene, sec-butylbenzene (0.05 wt.% based on the amount of tert-butylbenzene) and isopropylbenzene (<0.01 wt.% based on the amount of tert-butylbenzene). See Table 1 on page 25. A lithium secondary battery employing the electrolytic solution prepared from Example B-2 presents 91.1 % of retention of discharging capacity after 100 cycles. See Example C-3, Table 2 on page 27. Clearly, a lithium secondary battery employing a nonaqueous electrolytic solution containing a relatively smaller amount of sec-butylbenzene and isopropylbenzene (Example C-3) shows significantly improved cycle performance than that containing a relatively larger amount of sec-butylbenzene and isopropylbenzene (Example Z-3).

In contrast, Takahashi does not teach or suggest the improved cycle performance of a lithium secondary battery by reducing the amount of benzene compound having a benzene ring substituted with a hydrocarbon group having 1 to 4 carbon atoms via at least one tertiary carbon atom to 0.5 wt.% or less and more than 0.001 wt.%, based on the amount of the tert-alkylbenzene compound. Therefore, it would have not been obvious to one skilled in the art to combine Takahashi's components to arrive at claimed invention.

In view of the above remarks, Applicants respectfully request the rejection of claims 1-2

and 11 under 35 U.S.C. § 103(a) be withdrawn.

III. Conclusion:

Applicant respectfully requests reconsideration of this application and allowance of the pending claims in view of the above remarks.

**Except** for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 19-2380. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,  
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